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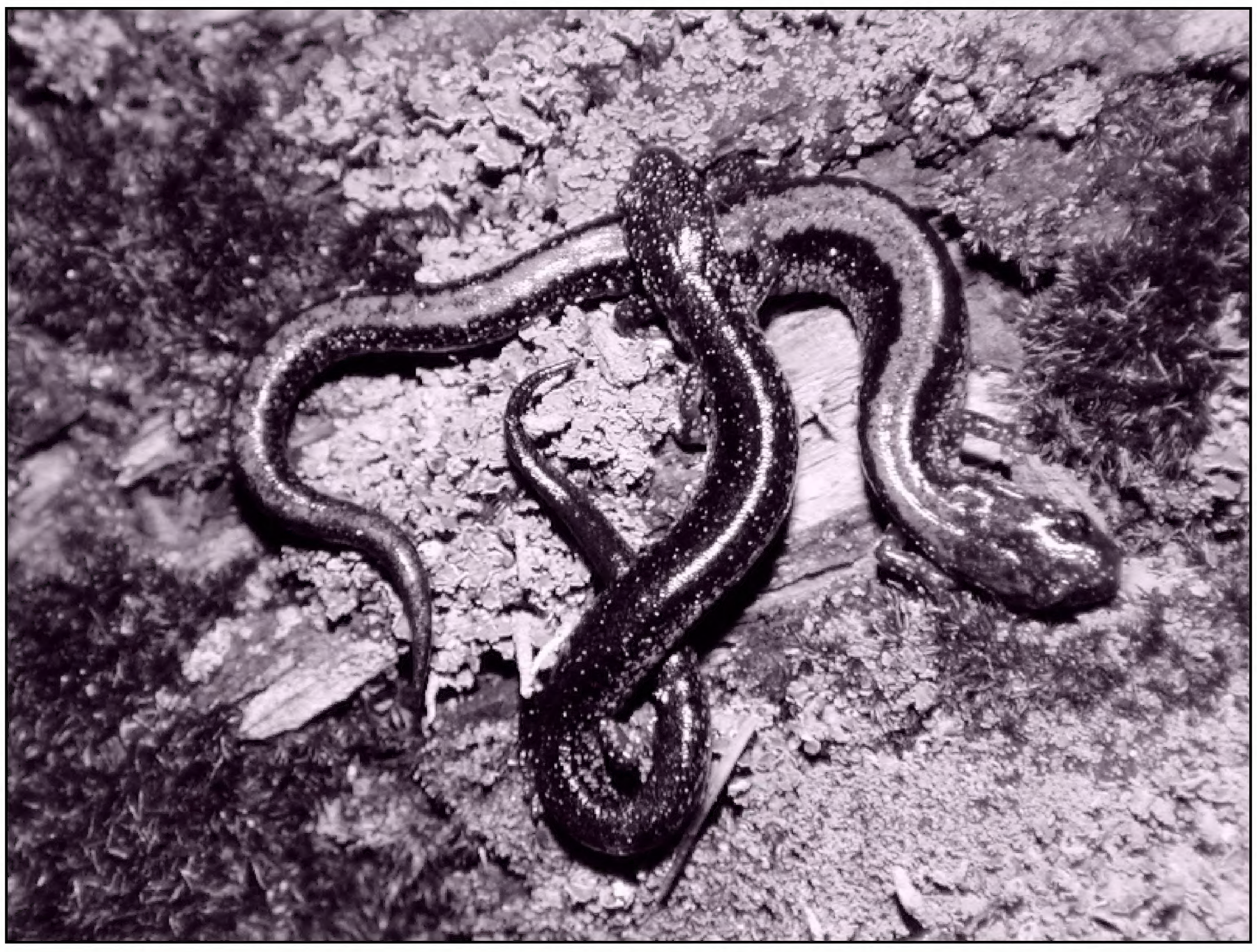

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Suggestions for Conservation of Midwestern Reptiles and Amphibians

Bill Leja
1634 W. Chase
Chicago, IL 60626

After watching the wild reptile and amphibian populations of the Midwest slowly sink toward oblivion over the last 40 years because of habitat loss and unsolved environmental problems, I decided to find out what can be done to prevent their decline. By reading and thinking about how to apply what I learned, I became convinced that there are many future actions to take and topics to research that can improve this situation. This essay is the result of that analysis. I have chosen to limit the discussion to conservation actions that, to the best of my knowledge, are not currently being taken in North America, and to conservation research goals that are not yet apparent in the North American literature. For example, I do not mention the conservation of ephemeral ponds because that type of habitat is already receiving the attention of restorationists. The problems of reptile conservation in the Midwest were not considered here to the same depth as those of amphibian conservation because, to be honest, I do not know as much about them.

1. Design of Ponds for Herpetofaunal Conservation

The design parameters commonly in use today for ponds—steep shores, often lined with ballast to prevent slumping of the shore; deep water; a surrounding lawn extending back 100 meters or more—may be ideal for sportfish, and may provide a nighttime watering hole for game, but are largely rejected as habitat by reptiles and amphibians. While ponds like these may look beautiful to some, and may even be valued by them as the jewels of showcase corporate estates or parks, they are displeasing to me because they are so unnatural in appearance. The herpetofauna of these ponds, if any, is depauperate, consisting of a few species that can survive or thrive there. It is the lack of rooted aquatic vegetation, the nearly universal presence of sportfish, and the lack of cover on the land surface surrounding such ponds that cause them to be largely rejected as herpetofaunal habitat.

European literature on pond design for general amphibian conservation indicates that shallow shore areas, particularly grassy areas that flood in the spring, are important for successful reproduction. Vegetated areas shelter adults and larvae and provide habitat for periphyton and invertebrates that serve as important food sources. It is essential to locate ponds in or close to acceptable terrestrial habitat—grasslands or woods—so that there is habitat for adult amphibians as well. Constructing a number of small ponds of various sizes and stages of vegetational succession is preferable to constructing a single pond. A different mix of species may develop in each pond, and that mix will change with time and succession to dry land. Aquatic vegetation should be allowed to develop unaided, and will do so rapidly in shallow areas. A buffer zone around a pond, within which fertilizers and pesticides are not used, is important. Heavy shading by trees reduces algal growth and is detrimental, causing ponds to become dystrophic. The bottom mud has been removed from hypereutrophic ponds to restore their acceptability to amphibians. An irregular shoreline and slope promote habitat diversity and thus promote biodiversity.

The concept of a *Biotopverbund*, or a network of habitats, is being developed by German herpetologists. There is no consensus yet on how far apart such biotopes (ponds) should be, nor what sort of landscape structures (e.g., hedgerows or ditches) are required to allow amphibians to migrate from pond to pond, but there is research aimed at determining how to repopulate agricultural landscapes with amphibians through these *Biotopverbunds* (e.g., Kneitz, 1998).

Research on designing ponds and creating habitat networks for urban and agricultural landscapes of the Midwest is clearly needed.

2. Problems Related to Sportfish Stocking

The U.S. has been very successful at developing funding mechanisms for agency fish and game activities. As a result sportfishing has been developed in this country farther than anywhere else in the world. This development has provided a great deal of income for fish and game agencies and their personnel. In contrast, funding for nongame conservation has failed miserably to keep pace with public interest. One result of this disparity in funding is a lack of knowledge of how the development of fisheries has affected the abundance of herpetofauna. Many fisheries practices cause problems that are largely unrecognized or unstudied today. However, there is no fundamental reason why sportfish culture should be incompatible with amphibian and reptile conservation. The nature of these problems needs to be understood. That understanding should be followed by public education on how to achieve compatibility between fisheries management and nature (that is, game and nongame) conservation.

a. Bullfrogs—A Complex Problem

The bullfrog is the midwestern amphibian species probably best adapted to steep-banked, vegetation-poor ponds surrounded by lawns and stocked with sportfish. The bullfrog actually benefits from the presence of fish, as Werner and McPeek (1994) discovered in southwestern Michigan ponds. These authors found that bluegills consistently increase the survivorship of bullfrog tadpoles many-fold, in spite of the fact that some may fall prey to the bluegills. They attributed this effect to the elimination of other predators and to noxiousness of the bullfrog tadpoles. They found that the bluegills completely eliminate ambystomid salamander larvae and virtually eliminate aeshnid dragonfly larvae from a pond. These larvae otherwise would have decimated bullfrog tadpole populations. In the literature that they cite there is a suggestion that other fish can have a similar effect on bullfrog tadpole survival. Because the bullfrog is territorial, the abundant offspring are forced to spread out to every conceivable aquatic habitat within reach; so one pond with bluegills may present a problem for many sur-

rounding ponds (and stream pools) by keeping them all saturated with juvenile or adult bullfrogs. Werner and McPeek (1994) also found that fishless permanent ponds that are not drained in the fall have very low bullfrog tadpole survivorship compared to ponds that are drained in the fall. Draining in the fall eliminates invertebrate predators. The significance of that finding for conservationists is that permanent fishless ponds that are not drained should produce few bullfrogs.

Since the bullfrog does not forage away from the edge of water, surrounding a pond by a lawn is not a factor in its habitat requirements.

Control of bullfrogs has been suggested as a way to prevent amphibian decline (Thurow, 1994). But it is apparent that the underlying problem is sportfish culture and design parameters for ponds. The pond fishes or pond fish communities that promote the development of large bullfrog populations need to be identified through research.

b. Largemouth Bass and Rooted Aquatic Vegetation

Ponds that have sportfish and bullfrogs, but also have shallow vegetated shore areas, can have a diverse herpetofauna as well if there are nearby seminatural areas. However, fisheries managers have a problem with rooted pond vegetation. Bluegills can breed very successfully in the vegetated areas and overpopulate the pond, leading to stunting. The stunted, starving bluegills eliminate largemouth bass through egg predation in spite of the fact that the male bass guards the nest. Such ponds are useless for fishing because stunted bluegills are of no interest to anglers. Adult anglers are not even interested in full-sized bluegills. But this sort of pond may fit well into urban areas where a lot of open shoreline is considered desirable for aesthetic reasons and only children fish. Also, it is impossible to prevent sportfish from being stocked in such ponds by "Helpful Henrys."

c. Limitation of Rotenone Use

The use of rotenone in fisheries management presents two problems. The first is that when it is used in winter just before a pond freezes it probably eliminates most or all hibernating or winter-active herpetofauna in the pond. Less rotenone is required under this circumstance (Roth and Hacker, 1988; Illinois Department of Conservation, 1992), providing an incentive to fisheries managers to do this. There should be a ban on use of rotenone at that time of year.

The second issue is that the use of rotenone to treat the entire length of streams that drain into a reservoir used for sport fishing, a step taken to eliminate unwanted fish species, is a highly questionable practice from the standpoint of preserving biodiversity. Merely checking to see if listed endangered species are present in the watershed is not a sufficiently high standard of care. Use of rotenone in streams is illegal in Canada. How does this practice affect the wildlife of streams?

d. A Compromise in Wetland Development

In Germany the most ecologically valuable wetland complexes are the locations most desired for aquacultural use (Meyer, 1978, cited in Hehmann and Zucchi, 1985), and that is likely also true in the American Midwest. Minnesota's natural wetlands are being devastated by game fish and bait fish aquaculturists who have converted them to rearing ponds (Lannoo, 1995). Upon completion of a report that clearly demonstrated that most amphibian species were eliminated from ponds within a wetland complex that were converted to trout production, Hehmann and Zucchi (1985) suggested a compromise: Government authorities should require, as a part of the permitting process, that at least 25% of the water surface area of a complex must consist of amphibian ponds and pools with shallow water zones of adequate size constructed at appropriate locations on the periphery of the wetland. The permit should include specific duties with regard to maintenance of the amphibian ponds. In that manner, they suggested, the ecological impact of aquacultural conversion would change from negative to positive.

3. Is there a Midwest Amphibian and Reptile Conservation Research Center in our Future?

When a member of the Chicago Herpetological Society asked if the fish in the pond at the Chicago Botanic Garden could be removed in order to help toads that were attempting to reproduce in small enclosures designed for protection of water lilies, she was told that the fish were necessary to keep mosquito populations down. While fish certainly prey on mosquitos, so do amphibians. One botanic garden, the Vitinsky Botanic Garden in Ukraine, uses amphibians instead for insect control. Culturing amphibians in a botanic garden would have much greater appeal to the public than the stocking of sportfish if it were part of a research effort designed to prevent amphibian declines. A research project on the grounds of a larger research site on the use of amphibians for insect control could provide opportunity for additional studies such as pond design parameters, the colonization of newly created ponds, and other conservation research; and could attract interested visitors. Public education leads to increased funding for such research activities and ultimately to better conservation efforts.

One interesting herpetological paper related to the control of mosquitos is Petranka and Fakhoury (1991). They found that a mosquito species avoided ovipositing in ponds containing bluegills or green frog tadpoles. Apparently the female mosquito was able to determine the presence of these predators by "tasting" the water with sense organs on its feet.

In the early 1980s an estimated 23 million frogs a year were imported from India and Bangladesh for the U.S. restaurant market. In the late 1980s both countries banned the export of frog legs to curb rising mosquito populations and pesticide expenses (Phillips, 1994).

4. Urban Herpetofaunal Conservation

a. Garden Ponds

Garden ponds can have a considerable effect on amphibians in urbanized areas according to the European literature. So far there has been no discussion of their conservation value in North American literature. A survey in Sussex, England, indicated that about 15% of gardens contained ponds and of these at least 50% were used as breeding sites by amphibians

(Beebee, 1979). Garden ponds throughout suburban London are considered more important amphibian habitat than the surrounding agricultural lands. After channelization of a section of the Inn River in Austria, backwaters that were cut off from the new channel changed, and for a time became filled with iron deposited by bacteria. During this time the formerly abundant amphibians of the backwater region of approximately 400 km^2 would have been extirpated if not for some garden ponds near the backwaters (Reichholf, 1996).

Garden pond owners should be discouraged from transferring eggs from far distant ponds in order to populate their pond. They also should be warned that breeding amphibians make a lot of noise and that fish and amphibians generally cannot both be expected to inhabit a pond.

b. Public Ponds in Urban Areas

How to provide habitat and habitat connectivity in urban areas for herpetofauna is a problem that could benefit from research. Reports of herpetofaunal surveys that have been conducted in European cities may suggest possible or proven conservation initiatives for urban areas.

c. Roads

The degree to which roads isolate amphibian populations or decimate populations that cross them on the way to breeding sites is being studied actively in Europe. Interest is so strong that members of the general public have been motivated to erect fences in the spring and carry migrating amphibians that collect at the fence across the road. Some roads are barricaded at migration time. Permanent tunnels under roads have been constructed. Substitute ponds that obviate the need to cross roads have been constructed. Much of this effort has been criticized because it is not accompanied with scientific studies of efficacy or need. When road networks become as dense as they are in large cities it is a wonder that any herpetofauna can survive. Midwestern efforts of this sort would be helpful, but they should be accompanied by appropriate studies.

5. Rural Herpetofaunal Conservation

a. Conservation of Smaller Farm Ponds

Smaller farm ponds are often located in upland regions of the Midwest where there are few remaining seminatural areas. Because of their scattered upland location these ponds could make a valuable contribution to herpetofaunal conservation. There are currently 45,000 farm ponds under one-half acre in size in Illinois—nearly one per square mile on average—according to the Illinois Department of Natural Resources (DNR) (1997). Ponds under one-half acre in size are useless as fisheries because the fish populations become stunted too rapidly (Lopinot, 1973). Bennett (1970) stated that ponds under one acre were useless as fisheries for that reason. In spite of their uselessness as fisheries, smaller ponds are nevertheless often stocked with fish, reportedly to dispose of excess hatchery production (Kohler and Hubert, 1993). That practice should be halted. In addition to publishing free literature that encourages landowners to use larger ponds as fisheries (e.g., Illinois DNR, 1997), state governments should be asked to publish literature that explains to landowners how to manage smaller ponds for wildlife conservation.

b. Benefit of Protected Stream Corridors to Herpetofauna

The most important herpetofaunal conservation activity for the rich farmland areas of the Midwest, where virtually the only land left in a seminatural state is along streams, is in my opinion the conservation of stream corridors. That can be accomplished by ceasing crop production on the land adjacent to streams. Since streams extend throughout the Midwest as a network, promoting their conservation may allow genetic flow for many species through the farmland that would otherwise be impossible. Rudolph and Dickson (1990) recommended a forested buffer zone width of at least 30 meters for conservation of reptiles, amphibians and other vertebrates. Brode and Bury (1984) found that riparian systems provide corridors for dispersal and islands of habitat for 83% of the amphibian species and 40% of the reptile species in California. Gore and Bryant (1988) recommended a buffer strip width of 30 meters on each side of a stream to prevent pollutants from reaching the stream. Because conservationists, recreationists, fishermen, hunters and environmentalists are uniformly in favor of this conservation effort, and it even benefits the farmer by keeping eroded soil on the farm, those interested in herpetofaunal conservation should join other groups in promoting stream corridor conservation initiatives.

Since woodlands often extend for some distance from stream corridors, ponds constructed in and at the edges of such woods should benefit woodland and grassland herpetofauna that may not be likely to inhabit or migrate through stream corridors.

c. Ecological Role and Functioning of Protected Stream Corridors

Crops such as wheat, rye and barley that completely cover the ground are disappearing from the Midwest and are being replaced with row crops—corn and soybeans—which provide poorer wildlife habitat (Warner et al., 1994). This change increases soil erosion by exposing more soil to the impact of raindrops. Livestock have moved from the family farm to the feedlots, where they are fed corn and soybeans grown on the row crop farms. That change reduces the acreage of pasture, which is better habitat for amphibians than row crop fields (Cooke and Ferguson, 1976). Fertilizer use has increased rapidly in the last half century. Midwestern streams are so fertile now that they support copious growths of algae and few rooted plants, and have large daily fluctuations in oxygen levels (Ball and Bahr, 1975). When stream corridors are protected by ceasing agricultural use within the corridor, the new habitat that develops compensates to some extent for the loss of upland habitat, and allows the stream to recover from the insults caused by soil and nutrient pollution.

Stream corridors that are not used for agricultural purposes prevent water pollution, reduce flooding, provide areas for recreation, and provide wildlife habitat and migration corridors. Overland flow of rainwater from agricultural fields sinks into the ground of mature forest (Anderson et al., 1976) or prairie (Weaver, 1968) in a short distance because of the much greater permeability of those surfaces to rainwater. Any solids

carried from the farm field are deposited there. Dissolved ammonia and phosphates carried with the water are absorbed on clay particles in the soil of the corridor. Ammonia is taken up in plant growth or oxidized to nitrate. Nitrate moves readily through soil, but when it enters waterlogged soil in an undisturbed stream floodplain it is almost totally reduced by denitrifying bacteria to nitrogen in a distance on the order of 5 meters or less, even in winter (Haycock and Pinay, 1993). Cationic pesticides are immobilized by soil, eliminating any chance of polluting a stream in the absence of overland flow. Most pesticides are polar molecules and sufficiently large to be absorbed on clay soils just as they would be absorbed on carbon in a water purification process, so forcing rainwater into the soil will allow the clay in the soil of stream corridors to act as a general pesticide filter. Once immobilized in this fashion the pesticides likely will degrade before they reach the stream.

To the extent that it is consistent with conservation goals, recreational trails, canoe liveries and even homes can be constructed within stream corridors to enhance recreation and provide the opportunity for some to share this wonderful habitat with nature. Revenues from these developments and from increased fishing and hunting opportunities can help pay for corridor conservation. (Today because of stream pollution fishing in Illinois has become a lake and pond pastime. With clean streams it can again become primarily a stream activity.)

In time and in the absence of human manipulation even channelized streams will begin to meander and rebuild a natural structure. Rooted vegetation will become established along the shores and in quieter areas as a result of a reduction in nutrient load, an increase in water clarity due to reduced soil erosion, a reduction in peak flow rate during storms, and a higher flow rate between storms as the water is gradually released from the ground. The stream channel will become reduced in cross-sectional area and become narrower and deeper. The water will become cooler. Permanent and temporary ponds will develop along the stream as it changes course in its natural floodplain. These changes are predictable on the basis of the changes that have been brought about by agricultural development (Menzel, 1983). A diversity of habitats for herpetofauna will develop in time. Other faunal groups such as fish and mussels will benefit considerably.

Conservation Reserve Program funds are already in use in Illinois for protection of stream corridors. The Nature Conservancy has been working with landowners along the Mackinaw River in Illinois to establish a protected corridor there. Stream corridors in northeast Iowa have been protected in order to establish a trout fishery in that state. There undoubtedly is similar activity on other midwestern rivers. Easements limiting use of the corridors consistent with conservation goals are the best permanent conservation approach.

I hope these thoughts are helpful in developing and implementing conservation actions for Midwest herpetofauna.

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New *Plethodon shenandoah* Localities and Their Significance

Gordon R. Thurow
Western Illinois University
Macomb, IL 61455

Abstract

The endangered *Plethodon shenandoah* was previously reported from three mountaintops in the Shenandoah National Park. The aim of this study was to find more locations. Five additional Virginia Blue Ridge areas are reported here, indicating a former larger range at lower altitudes, and less dependence on talus areas. A previously unreported sympatry with *P. hubrichti* is noted. The importance of hybridization has previously been underemphasized, as well as its significance in the threat to *P. shenandoah*, which apparently will eventually be genetically swamped by surrounding *P. cinereus* at all known locations. A conservation method is suggested whereby "back-up" populations of *P. shenandoah* could be established outside the *P. cinereus* range, and even be "reconstituted" genetically from introgression populations, by using artificial selection and the founder effect. Preliminary results from two earlier Illinois *P. shenandoah* translocations indicate that they probably can succeed outside the *P. cinereus* range. No ecological damage has been noted, and if no other members of the genus are native to the translocation sites, there is little chance of genetic damage.

Introduction

Plethodon shenandoah was described in 1967 (Highton and Worthington, 1967) from three limited mountaintop localities in the Shenandoah National Park, all near the border between Page and Madison counties, Virginia (the northern three localities shown in Figure 1). From N to S, these localities are on mountains referred to as the Pinnacles, Stony Man Mountain, and Hawksbill Mountain. To my knowledge, no other localities have been given for this apparent high altitude relict, though other mountains have been searched. This form was listed as endangered by the state of Virginia in 1987 (Rosen-

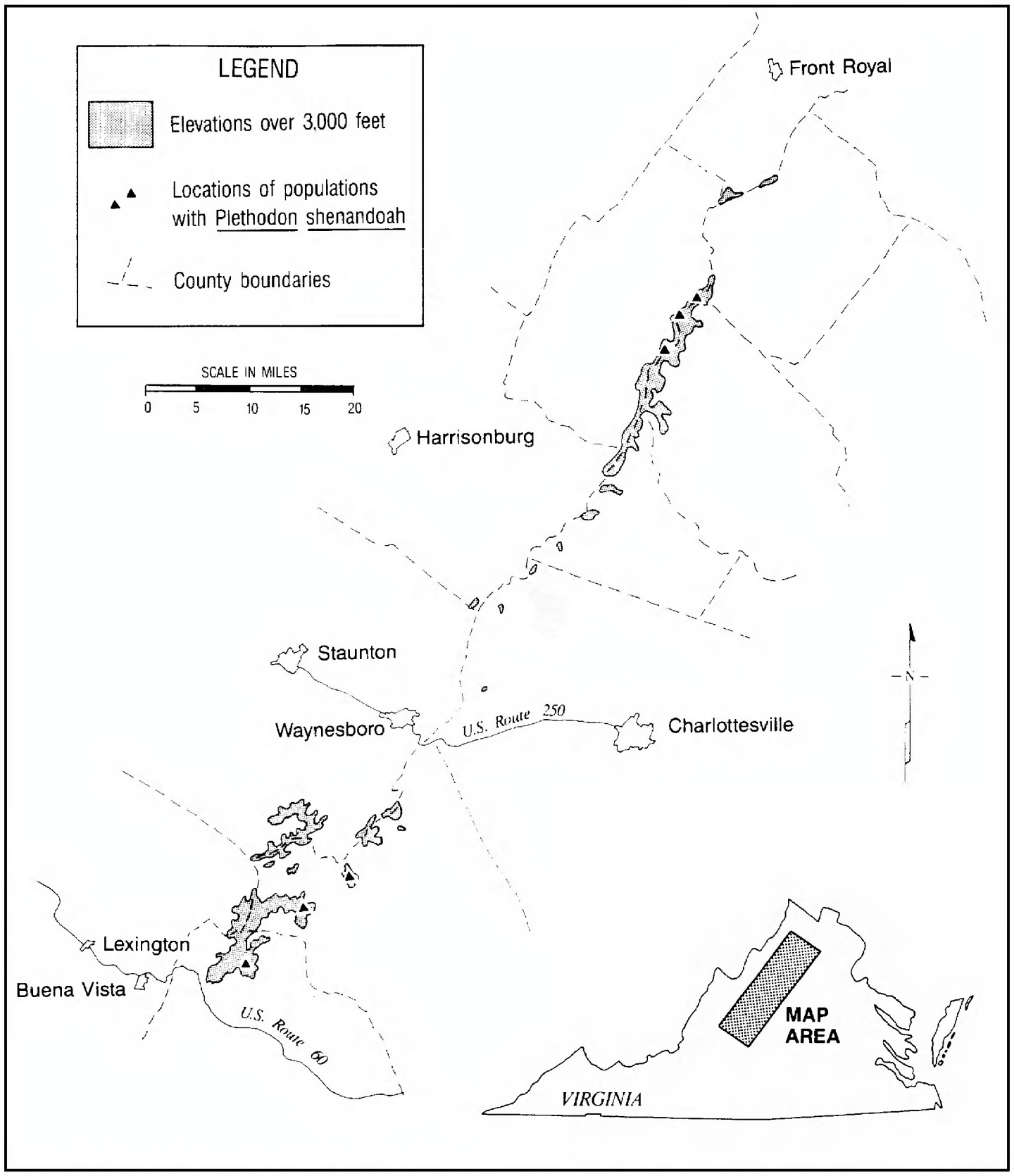

Figure 1. Some old and new locations for *Plethodon shenandoah*. From N to S, they are referred to as the Pinnacles, Stony Man Mountain, Hawksbill Mountain, Three Ridges, the Priest (Mountain) and Pompey Mountain.

berg, 1988). The aim of the present study was to find additional populations.

Methods

As in Highton and Worthington (1967), the procedure was to explore and record the presence of *P. shenandoah*, *P. cinereus* or hybrid phenotypes from new areas. No quadrat sampling or other quantitative sampling per area or time was attempted. When conspicuous talus areas were found, transects were sometimes made from the surrounding area, through the talus margin into the interior.

Results

Distribution

I noted that two of the three known *P. shenandoah* areas reached over 1,219 m (4,000 feet) in altitude, and that there were no more such peaks immediately to the N. To the S there were a few such elevations, but the Blue Ridge Parkway and other roads detoured around them. I visited three such areas between 1982 and 1989 (the southern three localities in Figure 1). From N to S, they are referred to as Three Ridges, the Priest (Mountain), and Pompey Mountain. These all contained populations containing phenotypes resembling *P. shenandoah* (Figures 2–4, from 1985 photographs). The first two areas are in Nelson County, Virginia, and the third is in Amherst County. Each of the southern three triangles in Figure 1 represents several nearby localities. Those unfamiliar with *P. cinereus* and *P. shenandoah* differences may compare Figures 2–4 with photographs, diagrams and descriptions in Highton and Worthington (1967), Martof et al. (1980) and Petranka (1998).

There was insufficient time to fully explore the Three Ridge area on my two visits (1985 and 1989). I got to the third high area (around 1,006 m) and found a Pinnacles area type situation (Highton and Worthington, 1967) with both forms intermingled at a NW facing talus pile. Some animals looked like *P. shenandoah* and some like *P. cinereus* (Figure 2), but some also were intermediate in appearance. Probably purer populations

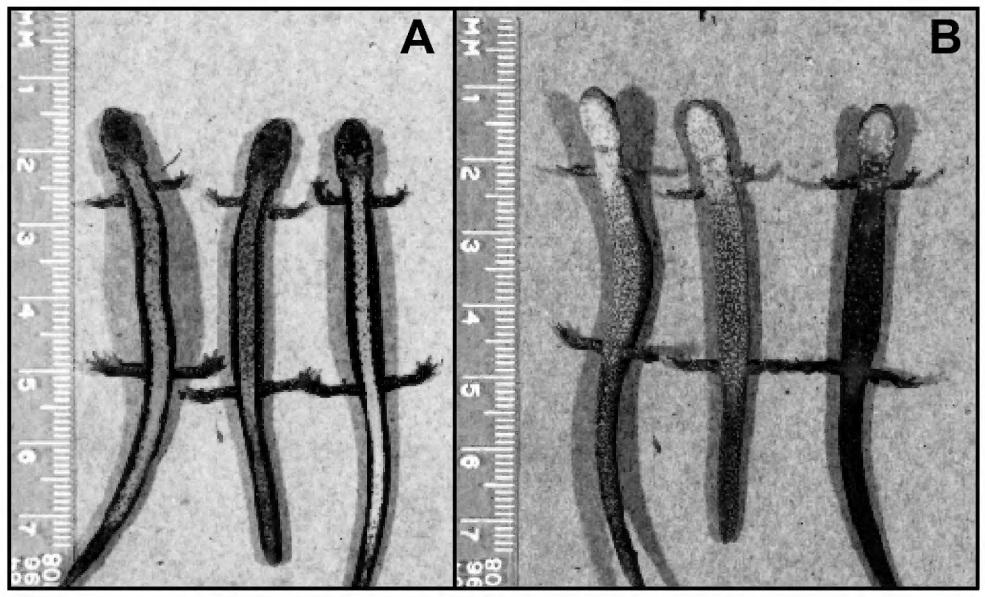

Figure 2. (**A**) Dorsal view and (**B**) ventral view of salamanders from a Three Ridge Mountain talus. The first two resemble *Plethodon cinereus* and the third resembles *P. shenandoah*.

of *P. shenandoah* exist on the farther part of this third ridge, which is "C" shaped and goes to over 1,210 m. It has additional NW facing boulder fields, visible from a distance.

I visited Priest Mountain twice (1982 and 1988), again finding mixed populations associated with older (humus-invaded) talus fields at between 1,036 and 1,128 m altitudes. But near the top of the 1,238 m mountain I found a N slope talus (boulder) field with animals like *P. shenandoah* in the center (Figure 3), although the periphery contained apparent hybrids, and the surrounding, non-talus, forested slopes contained *P. cinereus*. This *P. shenandoah* population is in a smaller area and is not as pure as the larger one at Hawksbill Mountain, but it is more like *P. shenandoah* than what I observed at Stony Man Mountain.

My 1989 experience at Stony Man Mountain was completely different from that of Highton and Worthington (1967), who reported finding no *P. cinereus* in the talus slope habitat there except at the edges. Trying to describe a mountainside is something like the fable of the three blind men who described the elephant. Others may have found a "core" population of good *P. shenandoah* phenotypes, perhaps near the lower cliffs (called "Little Stony Man Cliffs"). Facing out from the highest peak, I worked down to the left along the edge of the boulder field, and then went to the right towards the center. I collected no animals (having no permit), but examined more than 50. Most, more or less, resembled *P. cinereus*, some were obvious hybrid intermediates, and a few looked like good *P. shenandoah*, both black and striped forms.

There are some additional areas near 1,219 m in the Priest Mountain area. One is also by the Appalachian Trail, about 5 km W, and referred to as Maintop Mountain. Here in 1989 the NW facing talus area was humus-invaded, and again I saw a mixture of "*P. cinereus*," definite intermediates, and a few good *P. shenandoah* phenotypes. The relative number and purity of *P. shenandoah* phenotypes did not appear quite as much as in the Three Ridge or Stony Man areas, which I had visited the day before.

I also visited Pompey Mountain twice (1985 and 1987). Again some hiking is required, and introgressive populations were found past Hog Camp Gap in an old humus-invaded

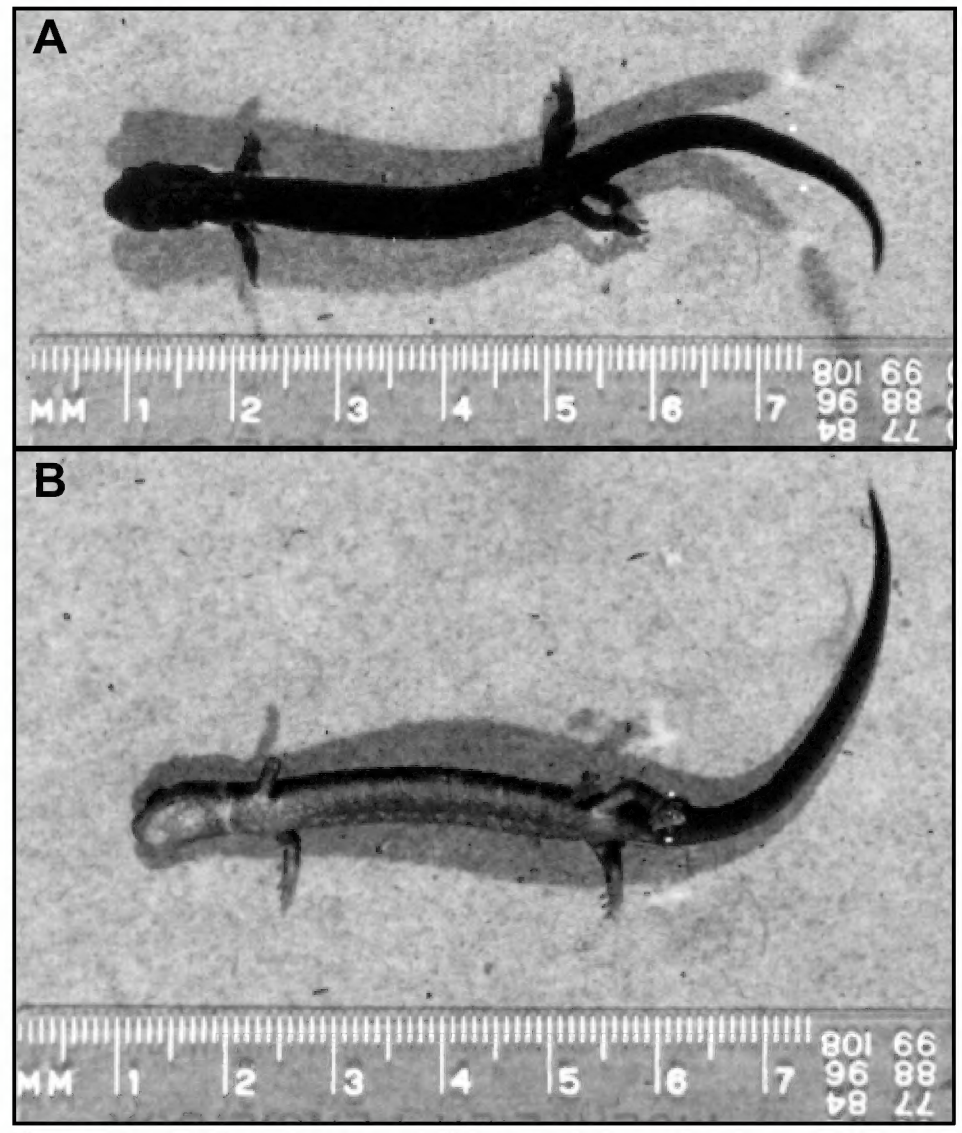

Figure 3. (**A**) Dorsal view and (**B**) ventral view of a preserved *P. shenandoah*-like salamander from a Priest Mountain talus.

boulder field at about 1,067 m. However, on Pompey Mountain near the 1,229 m top, there is another NW facing boulder field that goes up to around 1,189 m and has some better *P. shenandoah* phenotypes. This talus is old and partly invaded by humus, and the population varies from *P. cinereus* to the *P. shenandoah* phenotype (Figure 4). Only *P. cinereus* was found on the surrounding, forested, non-talus slopes. Mount Pleasant, to the S, is another peak rising to over 1,219 m. And as I drove S on highway 81, I saw NW facing boulder fields on one of the other such peaks near Pompey Mountain (probably Cole Mountain or Bald Knob), so there may be additional areas with *P. shenandoah* phenotypes.

I found still another area (not shown on Figure 1) of definite *P. shenandoah* influence, and a few fairly good phenotypes. This is the "Peaks of Otter" mountain mass, containing *P. hubrichti*, to the S. The highest peak is near the juncture of Botetourt, Bedford, and Rockbridge Counties, in Virginia. In 1988 I was examining salamanders, which appeared to be *P. cinereus*, SE of this highest peak. But then I noted that the black phase frequency was atypically high for the area. And as I descended into a hemlock seepage area I found some large specimens with narrow stripes, which tended more towards *P. shenandoah*. So in 1989 I searched talus areas on the NW side of the over 1,219 m peak, and did find some fairly good *P. shenandoah* phenotypes, as well as *P. cinereus* and intermediates, and also *P. hubrichti*.

Signs of genetically partly swamped relict *P. shenandoah* populations may also occur on still other peaks further S along the Blue Ridge chain. It is helpful to have recently examined other *P. shenandoah* populations in the field, so as to have a better mental standard for comparison.

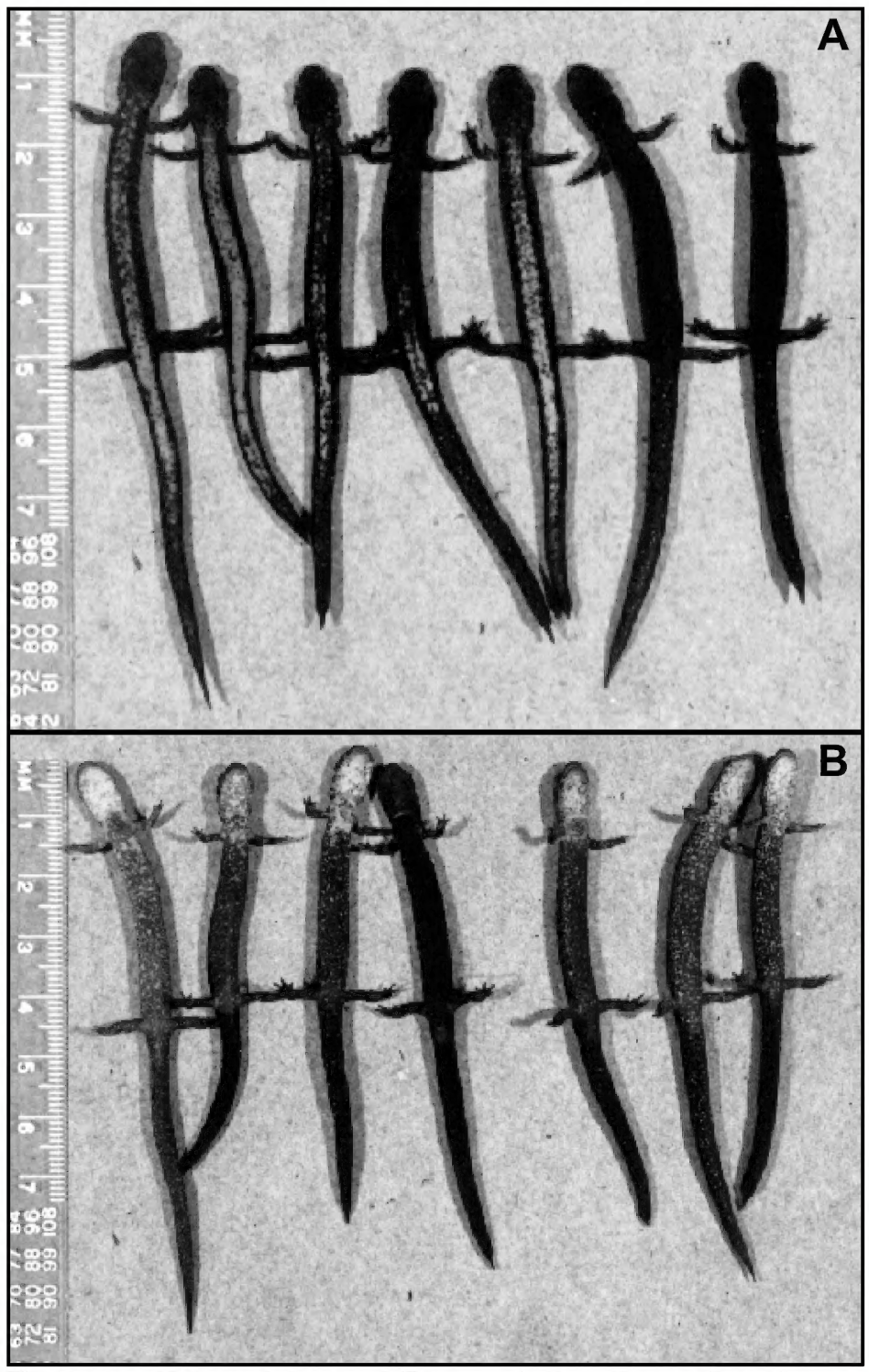

Figure 4. (**A**) Dorsal view and (**B**) ventral view of seven hybrid or introgressing salamanders (in the same sequence) from a Pompey Mountain talus.

Translocation

I have found that if food, temperature and moisture conditions are adequate, there are no unique local substrate or vegetation requirements for *P. shenandoah*. I have kept some alive from 1977 through 1985 in an underground outdoor cement tank in west-central Illinois (McDonough County), outside the present *P. cinereus* range. Additions were made from 1977 to 1979, and the last removal was in 1985. Actual translocations were also made at two man-made rock piles in forest of the same region, in 1980–1982 (69 animals) and in 1984–1985 (21 animals). The smaller release was only to test a rock pit in disturbed forest, but the other release was to a more mature forest. In 1999 animals resembling *P. shenandoah* are still found in these two areas. So successful translocations appear possible. However the future of these two minipopulations is limited, because they are surrounded by translocated *P. cinereus* populations. Hybrids are being produced, just as in the natural *P. shenandoah* populations.

Discussion

Distribution

All the isolated populations shown in Figure 1 and at the Peaks of Otter are obviously shrunken relicts of a once more extensive range up and down the Blue Ridge Mountains. The Shenandoah salamander must have also lived at lower altitudes, and was not as restricted to talus piles. The climate was cooler at one time according to Brooks (1967) and Peters and Darling (1985). Even today some *P. shenandoah* influence is found at somewhat lower altitudes, and all good *P. shenandoah* are not found only in talus piles. The *P. shenandoah* populations in the newer localities are in various stages of being genetically "swamped" by surrounding *P. cinereus*, and I believe the same process is also occurring at the three previously known localities. However, the new areas are additional reservoirs of genetic material for those interested in the preservation of this endangered *P. shenandoah* entity.

Ecological and genetic relationships with Plethodon cinereus

In R. Jaeger's extensive series of papers on the ecology of *P. shenandoah* and *P. cinereus* (reviewed by N. Hairston 1987, plus the more recent Griffis and Jaeger, 1998), he does not discuss the fact that hybridization is occurring between these two forms. Highton and Worthington (1967) do discuss and quantify peripheral introgression near the Hawksbill locality, and noted seeing some "obvious hybrids" there. Highton (1999) says that hybridization is confirmed by unpublished molecular (allozyme) data. My observations at Hawksbill, Stony Man, and the new localities all confirm hybridization (morphological intermediates). There are two patterns or "stages," and both are illustrated (Highton and Henry, 1970) for a similar situation involving *P. jordani* surrounded by the *P. glutinosus* complex. At some higher altitudes where the talus areas are still better developed, *P. shenandoah* populations maintain their integrity in central "core" areas, surrounded by an encroaching ring of hybridization. This appears to be the situation at Hawksbill and Priest, and possibly somewhere on Stony Man. Another later pattern is where *P. cinereus* genes have penetrated throughout the talus pile and its *P. shenandoah* population, partly submerging (swamping) the latter. Here one can find *P. cinereus* phenotypes, *P. shenandoah* phenotypes and intermediate introgressive phenotypes throughout the area. This appears to be the situation at all the other localities mentioned above, except possibly Pinnacles, the one locality I did not visit. Highton and Worthington (1967) did not report hybrids from there, but admit possible introgression.

Jaeger's picture of ecological replacement by *P. cinereus* should be expanded to include the genetic swamping by *P. cinereus*, which is also taking place. The picture of ecological differences between the two species is simply not as clear as drawn by Jaeger, and of course is made less exact by the fact that many hybrid animals are probably present at *all* of the presently known localities (more than eight). These morphologically intermediate animals are presumably intermediate in their ecological properties also.

Plethodon cinereus also occurs in many Virginia mountainside talus areas where *P. shenandoah* is missing (my experience, plus others, Highton and Worthington [1967]), and contrary to Jaeger's statements (1970 and 1974). And *P. cinereus* does not always stop at the edges of talus areas con-

taining *P. shenandoah*. The main threat to the long term existence of *P. shenandoah* is through genetic swamping by surrounding *P. cinereus*. Further, this advancing front of genetic introgression does not always proceed in perfect tandem with the invasion of the boulder field by humus and soil.

These boulder fields were presumably formed more actively by increased frost action during colder periods (i.e., in the Pleistocene). The reason for their tendency to occur on NW facing slopes apparently relates to the fact that the coldest wind chills come from the NW.

Conservation

Those who wish to preserve genotypes of the endangered *P. shenandoah* for posterity must 1) guarantee protection of adequate habitat, and 2) prevent genetic swamping by *P. cinereus*. There are very few remaining areas with relatively "pure" core area populations of *P. shenandoah*. The idea of "walling off" these populations from *P. cinereus* appears to be so difficult as to be impractical. Further, if climates warm, mountaintop relicts like *P. shenandoah* could become extinct anyway (Peters and Darling, 1985).

Introductions outside their historic range are sometimes an appropriate conservation solution to this kind of problem (Primack, 1998, p. 340). If suitable cool habitat could be found that is isolated from *P. cinereus*, then a translocated population of "pure" *P. shenandoah* could survive. Possibilities include isolated talus areas to the N, or on coastal marine islands or Great Lakes islands—if *P. cinereus* was shown to be absent. Island populations can be lost however, if water levels rise. My preliminary translocation studies (above) indicate that *P. shenandoah* probably can be translocated successfully. During a 20 year period, no negative effects have been noted on the local environment. This is not too surprising, since salamanders of the same genus and ecological guild occur widely in the eastern deciduous forest. If translocations are made to where no native *Plethodon* occurs, then genetic damage is unlikely.

If, in an event of some environmental catastrophe, no more "pure" *P. shenandoah* survived, the entity could still be redeveloped from introgressive populations by "backcrossing" and artificial selection. The procedure would be to pick out some of the most *P. shenandoah*-like animals and translocate these to a new location isolated from *P. cinereus*. This would utilize the "founder effect" to establish a population more like *P. shenandoah*. Phenotypes arising later which resembled *P. cinereus* would be removed. Years later the whole process could be repeated from this "improved" population. If this procedure proved successful, more than one such "back-up" population could be established in the event of climatic warming and Blue Ridge Mountain *P. shenandoah* decline.

Acknowledgments

I would like to thank Dennis L. Carter and Robert P. Jacobsen for earlier permits to collect *P. shenandoah* in the Shenandoah National Park before 1984, and Arthur C. Allen and Bambi Teague for permits to collect on the Blue Ridge Parkway. Travel expenses were partly supported by Western Illinois University Research Council grants.

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Bull. Chicago Herp. Soc. 34(12):274, 1999

The Herpetological Left: Definition and Quintessential Example

David Chiszar
Department of Psychology
University of Colorado
Boulder, CO 80309-0345

Hobart M. Smith
Department of EPO Biology
University of Colorado
Boulder, CO 80309-0334

Whereas traditional herpetology deals with the systematics, behavior and ecology of extant and extinct amphibians and reptiles, there have always existed fringe elements that depart somewhat from this hardcore right. Among these fringes or subdisciplines are several that lie close to the right, such as husbandry and herpetoculture, and several that are farther away, such as herpetological art, jewelry, artifacts and clothing. The field of herpetological anthropology, studying the roles of herpetological images in cultural practices and belief systems, gets even farther from the right, particularly when the researchers get into intrapsychic and related types of interpretations. But there is a farther left point of the continuum that gets into dragonology, and like all the other fringes, this one is of interest to at least some herpetologists, both amateur and professional, as well as to a vast array of mystics.

Dragonological literature ranges from psychoanalytic to spiritual to fantasy, but most herpetologists have little reason to consult these materials. Nevertheless, many of us have found ourselves fascinated by viewing the various artistic forms that dragons take, such as eastern versus western, and wondering about the respective evolutionary histories of these creatures. For most of us, the pursuit of such questions is thwarted by the meager size of our personal collections and, hence, the absence of a view of the variation within these two clades. A substantial museum collection exists, however, and we wish to bring it to the attention of our colleagues. It's in Chattanooga, Tennessee, near the intersection of I-75 and I-24, and it's called Dragon Dreams Museum. Assembled by Barbara Newton, DVM, the collection contains between 3,500 and 4,000 items, and the Gift Shop contains another several hundred. Marie Fitzgerald has the title "dragon keeper," and curates the collection; she is the person you are most likely to meet if you visit the museum. The address is 6724-A E. Brainerd Road, Chattanooga, TN 37421 [phone: (423) 892-2384; E-mail: dragons@dragonvet.com; website: http://www.dragonvet.com]. The regular hours are Wednesday – Saturday, 10 A.M. – 6 P.M.; Sunday, 1 P.M. – 6 P.M.; closed Christmas Eve, Christmas Day, New Year's Eve; New Year's Day, Easter Sunday, Independence Day and Thanksgiving Day. Admission charges are $5 for adults and $2 for children; but you don't have to pay these charges to enter the Gift Shop.

We can assure you that the museum is well worth visiting, even if you have no young children, as the entire natural history of dragons will sprawl before your eyes. Children, of course, will see matters through their own eyes which will be widened by this collection and gift shop.

Figure 1. A western dragon. Black and white print (54 × 44 cm) purchased for $12.50 from the Gift Shop associated with the Dragon Dreams Museum.

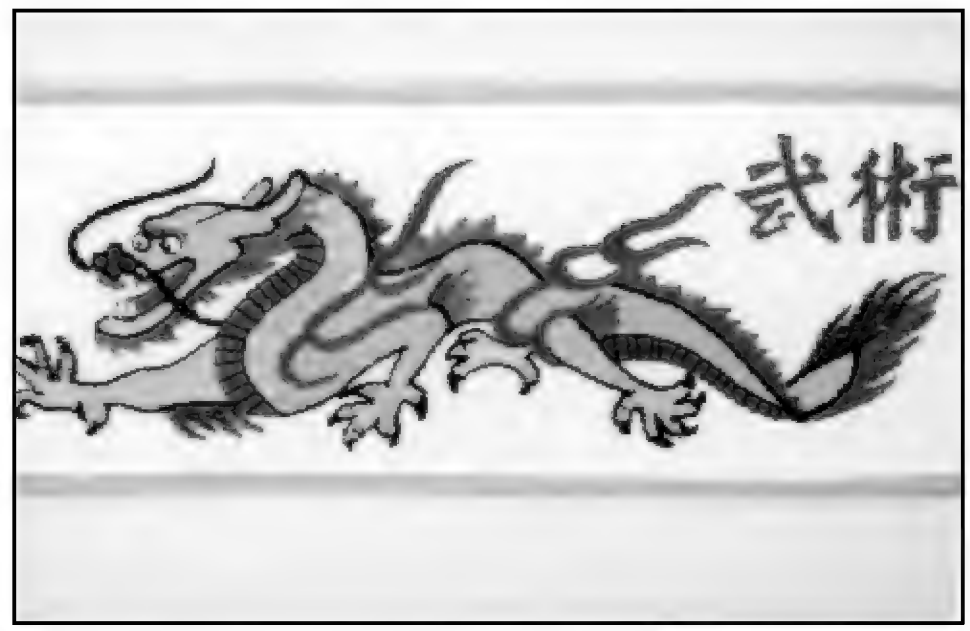

Figure 2. An eastern dragon. A textile patch (20 × 8 cm) purchased for $7.50 from the same Gift Shop. Numerous specimens of eastern and western dragons in many genres were available.

Bull. Chicago Herp. Soc. 34(12):275-276, 1999

HerPET-POURRI

by Ellin Beltz

Most disgusting behavior by a corporation in 1999 award
"KLM Royal Dutch Airlines will never again ship rodents, reptiles and endangered animals following an outcry over its destruction of hundreds of squirrels in a shredding machine, the company said. . . . [They already had] suspended shipments of rodents, amphibians and reptiles earlier this year after admitting that [they] dumped 440 illegally imported squirrels into an industrial meat processing machine on April 12 after failing to find them a home," according to the *News-Star*, October 30, 1999, from Martha Ann Messinger.

Just not his day
A 30-year-old licensed gator trapper in Florida is in the red after being attacked by an alligator that he tried to remove from the middle of a golf center road. Turns out the man, who has been a trapper for five years, has no health insurance to cover the treatment of having "big chunks of meat the size of half dollars [ripped] out of [his] calf," according to the *Reading Eagle/Times*. [October 2, 1999, from Walt Loose]

Snakes, apples; how fin de siecle
A *London Observer* story warns Britons who plan to visit the big Apple that the latest fad in Manhattan, New York, is colorful, live snakes in ladies' purses. Somehow I fail to see why one would have to warn tourists about anything done by native New Yorkers (like myself) as one usually expects the worst anyway on the Island. And why would the author have been looking in ladies' purses anyway? [*News of the Weird, Chicago Reader*, October 1, 1999, from Ray Boldt] This reminds me of the time one of my sisters-in-law went in my herp pack (it really wasn't a purse) and found the tin of maggots I had just bought to feed a lizard. You could hear the screams all the way out in the yard. She did promise never to "go in your purse again" and no one had the heart to ask her what she'd been in there for in the first place!

Another New Jersey reptile fire
I had to read the date on this one several times before I was sure I'd never used it before. The story reads, "A fire sparked by two explosions gutted an aquarium in [Ocean City, NJ]. . . killing at least three dozen animals. A few survived, including a turtle, an 18-foot African rock python and three alligators. . . . Investigators had not determined the cause of the explosions. . . . At least 12 iguanas and 24 snakes were killed. Firefighters spotted the python slithering through the building as they were putting out the last of the flames." [Little Rock, Arkansas, *Democrat-Gazette*, November 1, 1999, from Bill Burnett]

The Pennsylvania Perspective
Walt Loose sent in a whole bunch of stories from the *Reading Eagle/Times*, of which the next two tales really stuck out. I'm so accustomed to "Eek, a horrible snake!" articles that it's refreshing to hear about the discovery of a two-headed queen snake by a 13-year-old Latrobe resident. The picture shows both heads alert and snaking around the finder's fingers. [October 2, 1999] Another was headlined "Actually, there's a lot to like about turtles and snakes," and advises, "If you encounter a reptile in your back yard, in most cases, it's not just a good idea to refrain from using your Louisville Slugger; it's the law." Anyone discovering a snake on the property is advised to call the police or animal control. The article points out "Unfortunately for most reptiles, human imagination creates a venomous copperhead or timber rattlesnake out of every slithering reptile that trips a surprise button." Believe it or not, Pennsylvania still permits rattlesnake hunting with a bag limit of one in a two-week season—and you must have a paper permit from the Pennsylvania Fish and Boat Commission <http://www.fish.state.pa.us>. [August 1]

Only in the U.K.
David Blatchford sent this lively piece from the *Daily Mail*: "As a judge presiding over eviction proceedings, Lord Johnston was well used to hearing tales of woe, heartache and suffering." So he stopped a repossession effort by a bank against a family based on the argument that the 10-year-old child's seven-inch pet water dragon has a right not to be turned out in the cold, which would endanger its life. The judge asked the bank's lawyers, "Will you give me an undertaking not to do anything for 24 hours at least in the interests of the lizard?" And the counsel for the bank "promised that the animal would not be disturbed and suggested that animal welfare experts become involved." This all started when Sheriff's officers "began the eviction process, but came across the lizard. They tried to find it an alternative home but were concerned that it might die if they took it away from its environment." The owner of the house said, "Everything I own is at stake here. I can't believe the fuss about the lizard." [March 30, 1999]

Another cool website
I really enjoyed the eighth edition of the *Box Turtle Research and Conservation Newsletter* sent to me by Heather Kalb. You can visit their website at <http://www.bio.tamu.edu/users/heather/boxturt.htm> or write her at the Department of Biology, T.A.M.U., College Station, TX 77843. I found fascinating an article about how poorly translocated captive turtles do when released, fed and monitored in a nature education center property. Apparently some long-term captives do not learn to pull their heads in at night—leaving them easy prey for feral cats and other predators. Other articles include the whole scoop on the Kansas sting operation which busted oodles of people for selling ornates and an update on the Louisiana box turtle legislation. Anyone interested in turtles needs to subscribe to this publication—it gets better with every issue.

A more primitive disaster averted
An animal control officer in Mount Dora, Florida, saw an alligator swimming toward a small child playing in the shallows at a duck-feeding area in a local park while the child's minder was on a bench about 20 feet away. He ran and jumped feet first between the gator which was just opening its mouth and the toddler. He then grabbed the child and passed it to the

grandmother who had been on the bench. The gator swam away, but was later destroyed. [*Orlando Sentinel*, October 19, 1999, from Bill Burnett]

Cutest Y2K bugeater
Some unknown sculptor came up with a lovely stylized ranid which is bright green and shaped so that he perches on the corner of a computer monitor with one large webbed foot hanging over the edge. The text says it will eat Y2K bugs and do regular debugging of all your files and they claim its tongue is so lightning fast that you'll never even see it move. [*Toscano Galleries Catalog*, Winter]

OK, 60 feet long is HUGE!
Quite a few CHS members saw *Jobaria* for the first time the other night. And for all of us, it was the first time we had seen both individuals' casts fully articulated and mounted as they will be for the Navy Pier exhibition which starts January 14, 2000. Because I had late lab that night at NEIU, Ken Mierzwa, Kevin Goldman and I got to the dinner after cocktails were over. So we enjoyed walking through the cocktail area actually being able to see all the displays and the tables—the excavation pits, the photo stations and the tents—without a whole bunch of people there, too. We went down the stairs and into the Grand Ballroom of Navy Pier just as Bill Kurtis was putting on his mike as the Mesozoic Master of Ceremonies, in charge of introducing both *Jobaria* individuals to the assembled multitude of about 450 people. He hopped into a jumping jack—one of those lift scaffolds used most probably to assemble the dinosaurs—the stage lights came on, and for the next two-and-a-half hours we were entertained by a series of videos, slides, music, African drummers, and rousing speeches by Paul Sereno, Gabrielle Lyon, the chairman of the event, and Bill Kurtis. Meanwhile a whole bunch of money was raised for the next expedition; including one lady who bid $40,000 to go on it as a guest! But even with all this, I was most amazed by the creatures themselves. They're Cretaceous sauropods, but odd sauropods. They're primitive: they have remarkably short necks and very odd forefeet and claws. But I found myself fascinated by a series of spines on the underside of the few neck vertebrae and how they move on the specimen that is mounted rearing up with its head curved forwards. The more juvenile animal (teenager) is mounted with the neck out flat and these spines all line up and protect the throat in this configuration. It was the juvie which had the *Afrovenator* bite marks, but whether the carnivore killed it or merely scavenged it after the flood event which buried both individuals is unknown. What is known is that there's another new dinosaur still buried over there. And that Paul and Gabe are going back for it in the summer/fall 2000 season. And that one extremely lucky lady (and the friend of her choice) is going too. Don't miss the "Dinosaur Giants" on Navy Pier, January 14 through March 19 next year. *Afrovenator* will be with them in the Crystal Garden. And it's free—because these are your dinosaurs for helping with *Dinorun* and all the other fundraising events. Hats off to Lori King-Nava, Gary Fogel and all the other CHS members who helped make the *Dino Dinner* such a fun event. Big waves to the Junior Paleontologists, especially Marco Mendez who told the multitudes what it means to be a J.P. And to the chair of the event who looks so good in a predatory dinosaur mask and who must have worked like a slave to pull it all off! Bravo to the grad students who would be staying after the party ended at 10 to disassemble and pack both mounts because the next worthy cause to use the Grand Ballroom was beginning their set-up at 4:00 A.M. the next day. And thanks to the 450 who came, saw, ate and gave generously to support Project Exploration and Paul Sereno's efforts.

Thanks to everyone who contributed this month. Don't hesitate to send stuff—including your cutest herp holiday cards to: Ellin Beltz, 1647 N. Clybourn Avenue, Chicago, IL 60614-5507. Send whole pages of newspapers or publications. Be sure your name is on each piece. Have a happy and safe holidays and let's all hope Y2K is just a tiny bug—not the grasshopper that ate Wrigley Field. See you again in the new year!

Visit the CHS Website at
http://www.chicagoherp.org

It's where to find:

- Herpetological headlines
- Herps of Illinois, with photos
- Calendar of events
- Society information (membership, bylaws, back issues of the *Bulletin*)
- Contact information for board members and committees
- Book reviews
- Photos
- Grant awards
- Links to other herp sites

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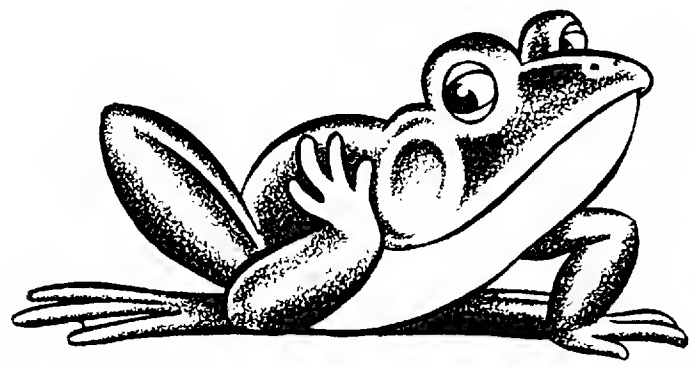
The Tympanum

What Is PARC and Why Should You Care?



Partners in Amphibian and Reptile Conservation (**PARC**) is a recently developed initiative designed to address conservation of reptiles and amphibians. PARC is poised to find the solutions to the problems faced by herpetofauna. People who have an agenda that in some way involves snakes, frogs, turtles, salamanders, lizards, or crocodilians should find out about PARC.

The PARC Mission Statement puts it succinctly:

To conserve amphibians, reptiles and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public/private partnerships.

These beleaguered animals and their habitats may at last have people on their side, in North America and perhaps the whole world. Reptiles and amphibians have been steadily disappearing from much of the United States during the past few decades. Everyone is familiar with the amphibian problems, but the reptile plight is every bit as severe. One example is the southern hognose snake, a small harmless species that once lived from Mississippi to North Carolina. No specimens have been seen in Alabama or Mississippi for more than 18 years. Another is the eastern indigo snake, the last sighting of a native specimen being reported from Alabama more than 40 years ago. And, of course, an amphibian, the flatwoods salamander of the Southeast, is the most recent species to be added to the federal list of threatened species. And the list goes on and on, from California to Maine to Florida.

PARC could be the answer to helping maintain the herpetofaunal component of our country's natural heritage and recovering some of what we have almost lost. PARC's organizational meeting in Atlanta in early June was the first national gathering. Based on attendance, PARC is the most diverse group of individuals and organizations that have ever worked together to address the problems confronting reptiles and amphibians on a national and global scale.

Diversity has become a symbol of strength, health, and well-being in biological communities, and so it is with societies and organizations. The more than 200 individuals who attended the organizational meeting represented 170 organizations. Included among the participants were representatives of museums, nature centers, state wildlife departments, universities, federal agencies, conservation societies, research laboratories, forest products industry, the pet trade, and environmental consultants and contractors. The attendance included participants from 33 states, Canada (British Columbia), Mexico (Mexico City), and the District of Columbia. Many of the groups are unaccustomed to working together, but the time has come to put aside differences of opinion and to hear all sides. No one has an interest in eliminating more herpetofauna, but solutions for the conservation of wild populations vary among government agencies, conservation groups, and private industry. All sides must be listened to and all must be allowed to participate, because all can contribute to solving the problems. The diverse mix of people and organizations will not only be able to identify the problems confronting native herpetofauna but will also be able to implement solutions and provide the support needed to assure the effective conservation of native herpetofauna.

One consensus among the participants at the PARC meeting is that a key goal in developing a sustainable approach for conservation of reptiles and amphibians should be to familiarize the public with the organisms and their habitats so that everyone develops an appreciation for herpetofauna. Public support of such an effort, with any group of fauna or flora, is a vital ingredient for a long-term solution.

Some people have asked: Why should people care about reptiles and amphibians? My first response is: Ask the millions of people in the country who do care. For every person you can find who says he does not care about what happens to turtles, frogs, or salamanders, I can find ten or more who do care. Most people have just never been asked. In fact, a majority of U.S. citizens would be supportive of a nationwide conservation effort, not just for reptiles and amphibians, but for all wildlife.

Herpetofauna represent a major part of our natural heritage. If these animals are in trouble, we are in trouble. Reptiles and amphibians are sentinels of our environmental health. If they are declining and ultimately disappearing, we need to make amends. What happens to herpetofauna is a sign of what could happen to other wildlife and maybe even to us.

PARC is not looking for scapegoats but instead is looking for partnerships with people who want to do the right thing, who want to set the score right in the nation's conservation efforts towards herpetofauna, towards all reptiles and amphibians. My impression is that the PARC concept will be highly successful and lead this country and others onto the path of conservation of native wildlife. PARC has a vision of providing the remedies necessary to correct the environmental problems that confront this group of animals and their habitats. It may be the last chance we will have for us to assure that humans and herpetofauna can live harmoniously in today's world. Let us know if you want to participate (parc@srel.edu) or check the PARC website (www.parcplace.org).

What Can You Do to Help Reptiles and Amphibians?

- Visit the PARC website, now located at www.parcplace.org or communicate directly with PARC (parc@srel.edu).
- Determine how you might contribute to PARC's Priority Conservation Needs for Reptiles and Amphibians (see the PARC website)
- Lend your support to efforts by nature centers, museums or schools in your community that are involved in educational

projects directed toward reptiles and amphibians.

• Get involved in the regional or technical working groups. For current listings of chairs, check out the PARC website (www.parcplace.org).

How Is PARC Different?

Included among the characteristics of PARC that make it distinctive from all other groups with a focus on herpetofaunal conservation are the following:

• PARC includes reptiles under its purview as well as amphibians.

• PARC is habitat focused and is taking a strategic and cooperative approach to developing a broadly based conservation plan.

• PARC includes state agencies and the private sector, such as the timber industry, as well as specialists and non-specialists with an interest in herpetology.

• PARC will focus on not only endangered and threatened species but will also work toward the objective of "keeping common native species common."

Whit Gibbons, University of Georgia, Savannah River Ecology Laboratory, Aiken, SC 29802.

Unofficial Minutes of the CHS Board Meeting, November 12, 1999

The meeting was called to order at 7:32 P.M. Board members Gino Martinez, Jennie Picciola, Marcia Rybak and Don Wheeler were absent.

Officers' and Committee Reports

The minutes of both the September and October Board of Directors meetings were read, corrected, and accepted. The Treasurer's report was accepted. Gary Fogel reported that $208.00 was contributed to Project Exploration.

Membership: Membership was reported at 836.

Shows: Vice-president Mike Dloogatch thanked Joan Moore for all her hard work at the Chicago Academy of Sciences grand opening show.

Library: The search continues for a new librarian.

Website: The possibility of linking the CHS website with an online book vender was discussed.

Adoptions: In January Rich Crowley will produce a summary of 1999's adoptions in order to track trends and growth patterns within the adoption program.

ReptileFest: Lori King reported that the dates of May 6-7 are locked in for the 'Fest but the contract still needs to be signed. *Reptiles* Magazine will include an article on ReptileFest written by Gary Kostka in the April issue, which will be out before the 'Fest. Jenny Vollman has letters for vendors and sponsors all ready to go.

CHS Merit Awards: Sergeant-at-arms Greg Brim reported that he has ordered the awards plaques.

Symposium 2001: Lori King said that Char Haguewood will have some information for us at the December general meeting.

Old Business

Jack Schoenfelder reported problems in his negotiations with the Chicago Academy of Sciences to move our general meetings to the Peggy Notebaert Nature Museum. They are not able to guarantee a specific night, such as "first Thursday" or "last Wednesday." There is no storage space available, which presents a problem for the library and raffle. And they cannot control the parking situation. Nevertheless, Jack is optimistic about reaching an agreement.

New Business

Corresponding Secretary Lori King will be writing a letter to Neiman Marcus in protest of an advertisement offering for sale a chair made from a saltwater crocodile and a trip to shoot this animal for $75,000.

Round Table

John Lovell said it felt nice to be back at a board meeting.

Mike Dloogatch mentioned that Chris Lechowicz is interested in forming a CHS chapter in Southern Illinois.

Steve Spitzer suggested that Marcia's reports should be moved to within officer's reports.

The meeting was adjourned at 8:52 P.M.

Respectfully submitted by Recording Secretary Karen Bielski

Bull. Chicago Herp. Soc. 34(12):279-281, 1999

Herpetology 1999

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

ASSESSMENT OF DISC CLIPPING EFFECTS

H. Lüddecke and A. Amézqita [1999, Copeia (3):824-830] carried out a mark–recapture study of a highland population of the frog *Hyla labialis*, and assessed some demographic and behavioral consequences of their marking procedure, which consisted of clipping a unique combination of one or more discs from one or more fingers and/or toes of an individual frog. The immediate health hazards of disc clipping were minor. No regeneration occurred; thus marks were permanent. Recapture rate for adult males was 60%, for females 40%, and for juvenile frogs 6%. The number of discs removed (up to seven per individual) did not differentially affect recapture rate of males and females, nor their locomotory performance, site fidelity or homing ability. The removal of finger discs affected neither reproductive activity of adult frogs nor the clasping ability of males. The authors conclude that disc clipping is an adequate marking technique for demographic and behavioral studies of *Hyla labialis*.

ANOLE SPECIES RESURRECTED

G. Köhler and J. Kreutz [1999, Herpetozoa 12(1/2):57-65] found striking differences in hemipenis morphology between populations of anoles from El Salvador and Guatemala versus populations from Nicaragua and Costa Rica. All of these populations previously had been referred to a single species, *Norops cupreus* (Hallowell, 1860). The hemipenis differences as well as differences in the dewlap coloration of males (in life), warrant the recognition of *Norops macrophallus* (Werner, 1917) as a valid species. Consequently, the authors resurrect the latter taxon from the synonymy of *N. cupreus*.

RESPONSES OF LIZARDS TO HUMANS

A. Labra and R. Leonard [1999, J. Herpetology 33(3): 441-448] note that although humans are commonly used as surrogate predators to assess the antipredator behavior of lizards, little is known about the effects that life associated with humans may have on the escape behavior of lizards. This study examines the effects that coexistence with humans may have on the antipredator mechanisms in three species of *Liolaemus* (Tropiduridae). For each species the authors compared two populations exposed to different human densities, to test the null hypothesis that there is no interpopulational variation in the response to an approaching human in the field. Also it was determined whether coexistence with humans would affect the behavioral and physiological antipredator responses to a model of a natural predator in the laboratory. Lizard populations that were exposed to a high human density allowed a closer proximity of humans in the field, and decreased their rate of movement and breathing intensity in response to the presentation of a predator model in laboratory experiments. The authors discuss the effects humans may have upon the lizards' antipredator behavior toward humans and natural predators.

CORALSNAKE TAXONOMY

N. J. da Silva, Jr., and J. W. Sites, Jr. [1999, Herpetological Monographs 13:142-194] note that the New World coralsnake genus *Micrurus* has been taxonomically problematic due to extreme variation in color pattern and highly conserved morphological variation. These problems are exemplified in the *Micrurus frontalis* "group," and the authors present a monographic revision based on an analysis of over 2100 specimens (including all available types). The authors recognize the following seven species on the basis of unambiguous combinations of characters: *M. altirostris*, *M. baliocoryphus*, *M. brasiliensis*, *M. diana*, *M. frontalis*, *M. pyrrhocryptus*, and *M. tricolor*. A complete synonymy is given for each taxon, as well as a redescription of the holotypes. The report also characterizes morphological variation for each, and provides distribution maps and a key to the species.

COMMUNICATION IN A BRAZILIAN TORRENT FROG

C. F. B. Haddad and A. A. Giaretta [1999, Herpetologica 55(3):324-333] studied the signaling, territorial and courtship behaviors of the diurnal frog *Hylodes asper*. Visual and acoustic communication were used during intraspecific interactions involving males, females and subadults. *Hylodes asper* has a complex visual communication system, of which foot-flagging is the most distinctive display observed in the repertoire of visual signals. The splash zone produced by the torrents and waterfalls creates a high, nearly constant, humidity near the streams, reducing desiccation risk, and enabling the diurnal activity of *H. asper*. Although the ambient sound pressure levels (SPL), measured at the calling sites, are similar to the SPL of the advertisement calls, the high-pitched calls of *H. asper* are spectrally different from the noise produced by the water current. Thus, the ambient noise produced by the water current may not interfere significantly with acoustic communication in this species. The noise and high humidity produced by the torrents and waterfalls, along with the availability of light, probably favored the evolution of contrasting colors and visual communication in *H. asper*. Males excavate underwater chambers that are probably used to shelter the eggs and to prevent the clutch from being drifted downstream.

PROTECTIVE BALLING IN ANACONDAS

L. Dirksen et al. [1998 (1999), Herpetological Natural History 6(2):151-155] note that balling posture is known to occur in many boid species, and for the first time document that this behavior occurs in all species of the genus *Eunectes*. The behavior "balling posture" is proposed as a stereotypic behavior that protects the sensitive head and ventral side of a threatened individual after fruitless attempts to escape or fight. The animal tries to avoid the danger of being wounded by coiling around its own head. This defense mechanism seems to be triggered more readily in small anacondas than in large adults.

INBRED ADDERS GET GENE BOOST

T. Madsen et al. [1999, Nature 402:34-35] note that the negative effects of inbreeding on population size are well documented in captive animals, but there is surprisingly little evidence that genetic factors cause a decline in wild populations. The authors studied an isolated population of adders (*Vipera berus*) at Smygehuk, about 50 km south of Lund in Sweden. The adders are confined to a coastal strip of grassy meadow 1 km long and 50–200 m wide. They have been isolated from other adder populations for at least a century, and the nearest known population is 20 km away across agricultural fields unsuitable for adders. Previous reports have documented that the population declined dramatically about 35 years ago, and has since suffered from severe inbreeding depression, with a high proportion of deformed or stillborn offspring and very low genetic variability. Since 1981, all adders captured in the study area have been marked. Because of the small size and open habitat of the study area, all adult males can be captured during spring each year, when they bask in the open. Therefore, the authors' estimates of population number are based on adult males only. The population size at Smygehuk has fallen each year since 1983 (the decline from 1981 to 1995 is highly significant, $r = -.83$, $P = 0.0001$, d.f. $= 14$). The population was lowest in 1995, when only four males were caught. In spring 1992, the authors captured 20 adult male adders from large and genetically variable populations and released them into the Smygehuk population. They remained there four mating seasons, and the eight surviving snakes were captured and released back into their natal populations in 1995. Because male adders mature at about four years of age, the authors did not expect to see any effect on the number of adult males until 1996, which is what occurred. From 1996 to 1999, there were dramatic increases in the number of recently matured males recruiting to the population ($r = 0.96$, $P = 0.04$, d.f. $= 3$) and the total number of males captured ($r = 0.98$, $P = 0.02$, d.f. $= 3$), which peaked at 32 in 1999, the most recorded over the 19-year study. The authors also observed increased genetic variability during 1996–1999, as measured by polymorphism in the major histocompatability complex class I genes. The proportion of stillborn offspring also fell suddenly, indicating that the rapid increase in recruitment was due to increased survival of juvenile adders. Population data from 1983 to 1995 indicate that the Smygehuk adders were on the brink of extinction, with falling numbers and negligible recruitment. Introducing new genes from a different population enabled the adders to make a dramatic recovery. This result encourages genetic approaches to conservation and supports the importance of preserving genetic variability as a way of increasing the viability of wild populations.

FIRE-BELLIED TOADS MAKE WAVES

B. Seidel [1999, J. Herpetology 33(3):457-462] observed that roughly a third of *Bombina v. variegata* (Bombinatoridae, Anura) males performed a sex-specific territorial behavior in temporary pools during short-term spawning aggregations. The males rhythmically struck the water with their hind legs, creating wave patterns that demarcated territories situated in relatively deep and almost vegetation-free areas of the ponds. In such areas the probability of egg and tadpole development was increased, as compared to the shallow areas of the same pools. Non-territorial males actively searched for females and engaged in intrasexual scramble competition for access to females but rarely performed the water-wave-making behavior. Males performing water-wave-producing behavior were larger and had greater mating success than non-territorial males.

SNAKES OF MANAUS, BRAZIL

M. Martins and M. E. Oliveira [1998 (1999), Herpetological Natural History 6(2):78-150] present natural history information on 66 species of snakes found in the forests of the Manaus region, Central Amazonia, Brazil. For each species, they provide information on size, color pattern, habitat and microhabitat, feeding habits, reproduction, and defense. They also include a partial summary of the information available in the literature for Amazonian localities. Results are based on nearly 800 captures or sightings of snakes made from 1990 through 1995 at localities around Manaus, mostly at a primary forest reserve 25 km north of Manaus. Field data at this reserve were obtained during over 2600 person-hours of visually searching for snakes, ca. 1600 of which occurred during time-constrained search. Temperature and relative humidity in Manaus are high and the amount of annual rainfall (2075 mm/yr) is relatively small, with a long dry season (4–7 mo). Of the 65 species for which information is available, 28 (42%) are primarily terrestrial, 20 (30%) fossorial and/or cryptozoic, 13 (20%) arboreal, and four (6%) aquatic, although many species use more than one microhabitat when active. Nearly all inactive snakes were found on vegetation. In relation to time of activity, 26 (41%) of the 62 species for which information is available seem to be strictly diurnal, 13 (21%) strictly nocturnal, and 23 (39%) both diurnal and nocturnal. The five prey types most commonly consumed by snakes in the Manaus region are vertebrates: lizards (consumed by 58% of the species), frogs (39%), mammals (23%), birds (18%), and snakes (16%). A cluster analysis combining data on microhabitat use, diel activity, and diet resulted in several groups of species with similar habits. All these "guilds" included closely related species, as well as distantly related ones that converge in habits. These combined results indicate that in addition to current ecological factors (e.g., predation pressure, differential prey availability in different microhabitats), historical factors (phylogeny and biogeography) may have played an important role in determining the current natural history patterns of this snake assemblage. A high diversity of defensive tactics was found in this assemblage, and phylogeny may be a strong determinant factor for the occurrence of defensive tactics in each species. Contradicting generalizations on the timing and length of reproductive season in Amazonian snakes, juvenile recruitment seems to occur mainly during the rainy season in most species from the Manaus region, although some species seem to breed throughout the year. This may be a consequence of the prolonged dry season that occurs in the region, during which time some resources occur in limited supplies.

GEOGRAPHIC VARIATION IN *DENDROBATES HISTRIONICUS*

S. Lötters et al. [1999, Herpetozoa 12(1/2):23-38] studied advertisement calls of six populations of *Dendrobates histrionicus* and *D. occultator*. When the authors combined their results with published data on advertisement calls of other populations of *D. histrionicus* and *D. lehmanni*, two groups became evident: northern populations with relatively long notes (≥ 125 ms) and a low note repetition rate (2–3.5/s) and southern populations with distinctively shorter notes (≤ 100 ms) and a higher note repetition rate (at least 5/s). The northern populations, in addition, are similar in dominant frequency; hence, the authors regard them as conspecific and assign them to *D. histrionicus* sensu stricto. The authors tentatively suggest that the southern populations belong to at least three species: *Dendrobates sylvaticus*, which they revalidate, and *D. lehmanni* as well as *D. occultator*, the statuses of which deserve further investigation.

CONCHO WATER SNAKE REPRODUCTION

B. D. Greene et al. [1999, Copeia (3):701-709] studied the reproductive biology of the Concho water snake (*Nerodia harteri paucimaculata*) from 1988 to 1992 in central Texas. Minimum SVLs at maturity were 380 mm in males and 460 mm in females. Mating occurred primarily in late April and early May, although some evidence of fall mating was observed. Gestation was approximately three months. Parturition occurred predominantly in mid-August, ranging from 29 July to 22 September. Approximately 85% (range 79.5–88.8) of adult females were gravid each year with the proportion of reproductive females varying as a function of body size. Litter size averaged 11.1 (range 4–29) and varied both among and within study sites. Maternal SVL was correlated with litter size and mass but not offspring SVL or mass with litter size held constant. Litter size had no effect on offspring SVL or mass when female SVL was held constant. Relative clutch mass averaged 0.46 and was independent of female size. Mean offspring length and mass were 175 mm SVL and 3.8 g, respectively, showing no overall sexual differences. However, mean SVL was typically greater for females within litters.

TWO NEW GECKO SPECIES

L. L. Grismer et al. [1999, J. Herpetology 33(3):382-393] describe two new continental species of *Goniurosaurus*: *G. luii* from the Guangxi Province and the Island of Hainan, China, and *G. araneus* from northern Vietnam. An evolutionary classification consistent with the phylogenetic pattern (*luii* + *araneus*) + ((*lichtenfelderi* + *hainanensis*) + (*yamashinae* + ((*orientalis* + *kuroiwae*) + (*toyamai* + *splendens*))) is proposed, elevating the endemic insular subspecies of *G. kuroiwae* and *G. lichtenfelderi* to full species. A historical biogeographical scenario is presented invoking extinction of a continental ancestor of the *kuroiwae* and *lichtenfelderi* groups. Conservation efforts are needed to ensure the safety of the decreasing wild populations of *G. luii* and *G. araneus*, which are being exported out of their respective countries for the international pet trade at an alarming rate.

PALAU ISLANDS HERPETOFAUNA

R. I. Crombie and G. K. Pregill [1999, Herpetological Monographs 13:29-80] report on a survey of the herpetofauna of the Palau Islands of western Micronesia, which comprise one of the most physiographically varied archipelagos in the Pacific. There are some 350 islands of volcanic and coralline origin that range from Babeldaob at 333 km^2 (about 80% of Palau's total land area) to others, unnamed, of less than one hectare. A barrier reef encircles most of the archipelago creating a lagoon up to 20 km wide. The majority of the islands are uninhabited, accessible with difficulty only by boat at high tide, and are densely vegetated over steep, rocky terrain. Because of their proximity to the Philippines, New Guinea, the Moluccas, and Borneo, the Palau Islands host a significantly richer herpetofauna with more unique taxa than other Pacific islands to the east. As with most other Pacific island groups, however, the herpetofauna has been poorly documented. Since the earliest investigations that began in the nineteenth century, Palau's herpetofauna has been uncovered piecemeal. No sustained field effort had been conducted until the authors began a systematic survey of the islands in 1992. Since then they have collected in Palau every month of the year at least once. This checklist of 46 species of reptiles and amphibians includes almost twice as many taxa as were known from Palau at the beginning of this study. Among these are new species or Palauan records of *Gehyra*, *Hemiphyllodactylus*, *Lepidodactylus*, *Nactus*, *Perochirus*, *Emoia* and *Sphenomorphus*. Because of the difficulties in surveying so many islands the authors believe that additional taxa and distributional records await discovery; even the smallest island in Palau can turn up surprises. Nonetheless, it is appropriate to consolidate what is now known about this intriguing fauna and environment. This report provides a historical summary of previous collecting efforts, an overview of the islands' geology and habitats, and for each species account includes distributional information, taxonomic and systematic discussion, natural history observations, and a comprehensive bibliography.

RATES OF EMBRYONIC DEVELOPMENT

R. M. Andrews et al. [1999, Copeia (3):692-700] note that rapid embryonic development is a potential adaptation to cold climates. They tested this hypothesis for nine species of *Sceloporus* lizards from four species groups and one species of *Urosaurus*, an outgroup, using observations corrected for incubation temperature and hatchling size. Phylogenetically based comparisons indicated that relatively rapid development is characteristic of the *scalaris* species group and relatively slow development is characteristic of the *undulatus* species group. Comparisons within these lineages were therefore used to determine whether developmental rate was related to climate, as judged by elevation and latitude. Within the *scalaris* species group, developmental rates of cool climate populations of *S. aeneus* and *S. scalaris* were not faster than that of a warm climate population of *S. scalaris*. Within the *undulatus* species group, the developmental rates of cool climate populations or species were not faster than those of warm climate populations or species. In general, developmental rates of *Sceloporus* are lineage specific and do not appear to be adapted to local climates.

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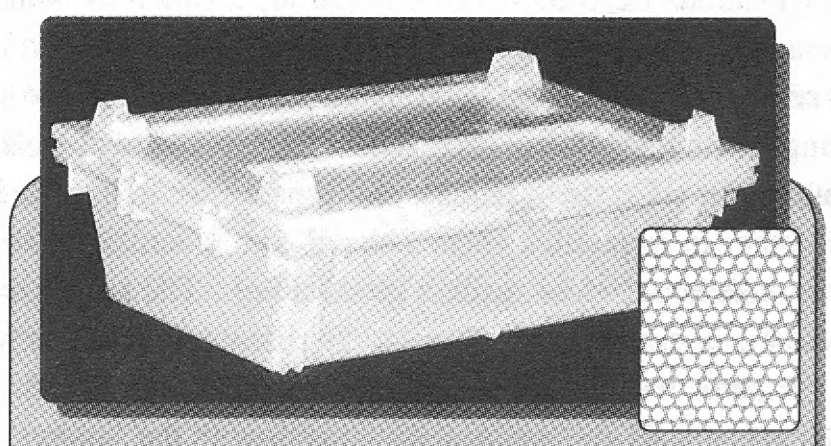

Nearly 9,000 holes and they still can't escape!

The new TTC is ideal for transporting, breeding and storing your mice, rats, snakes and lizards. The strong plastic TTC has over 2,200 holes on each side and over 4,500 holes on the lid to provide maximum air circulation even when stacked. Each TTC can be divided into 2, 3 or 4 compartments and its smooth plastic construction makes washing a snap.

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UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, December 29, at the Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, in Chicago. **Chuck Knapp**, University of Florida doctoral candidate and part-time Shedd Aquarium researcher, will speak to us about "Population biology of an introduced *Cyclura cychlura inornata* colony in the Bahamas." He will also briefly talk about his last iguana research trip to Andros Island. Chuck fell in love with rock iguanas (genus *Cyclura*) while working with them at the Aquarium. He has been studying *Cyclura* in the Bahamas since 1992.

Stephen L. Barten, D.V.M., will speak at the January 26 meeting.

We are required to use the entrance on the west side of the museum. **We are allowed to use the free parking lot to the west of the museum. Entrance to this lot is from McFetridge Drive, the wide street just to the south, between the museum and Soldier Field.** Public transportation is an option: the Roosevelt Road (12th Street) bus goes directly to the museum, thus providing a connection with the el and subway. This bus service runs until 11 P.M.

The Chicago Turtle Club

Chicago Turtle Club meeting dates have been changed to the last Sunday of the month. The next meeting will be a Holiday Potluck Party, Sunday, December 26, Noon – 4:00 P.M., at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Meetings are informal. Questions, children and animals are welcome. Parking is free. For more info call Lisa Koester, (773) 508-0034 or visit the CTC website: http://www.geocities.com/~chicagoturtle.

ELECTION RESULTS

As a result of the elections held November 24, 1999, the following officers and members-at-large will serve on the CHS Board of Directors for the year 2000.

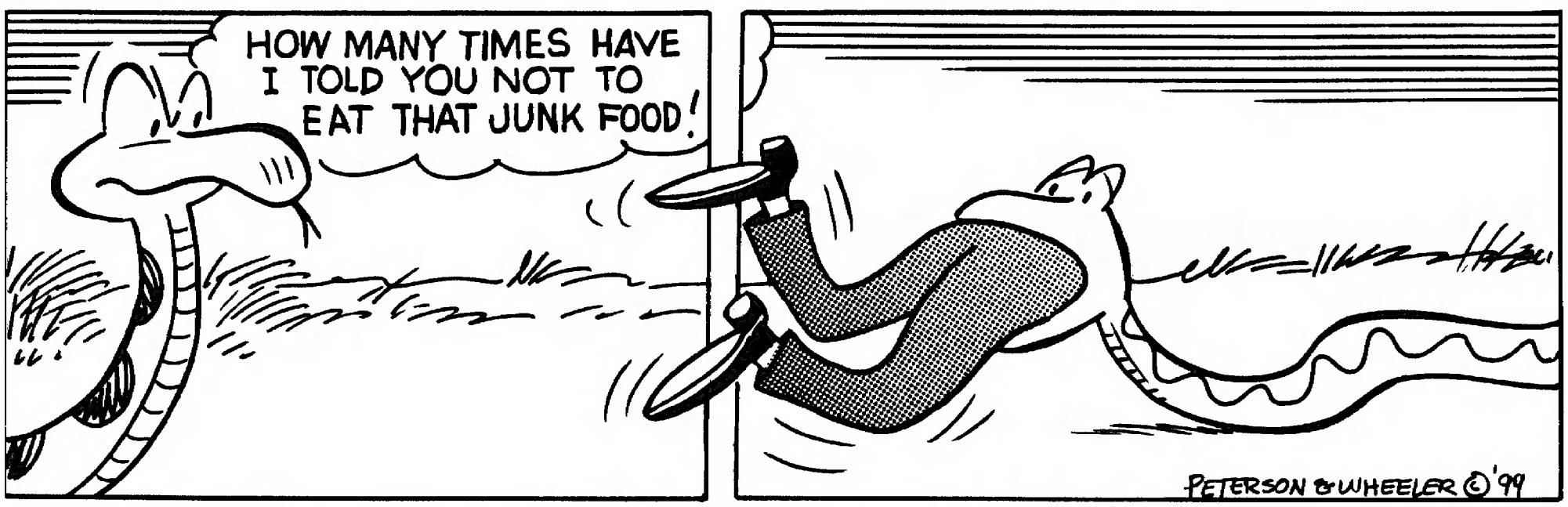
President:	Jack Schoenfelder	Membership Secretary:	Michael Dloogatch
Vice-president:	Lori King	Sergeant-at-arms:	Greg Brim
Treasurer:	Gary Fogel	Members-at-large:	Rich Crowley
Recording Secretary:	Karen Bielski		Jon "Iggy" Ihrig
Corresponding Secretary:	Steve Spitzer		Linda Malawy
Publications Secretary:	Marcia Rybak		Jenny Vollman

DONATIONS TO THE OCTOBER 27 RAFFLE

The following is a listing of those businesses and individuals who generously donated items for our monthly raffle at the October 27 meeting. The donated items are shown in parentheses.

Hagen (OrnamentAlls bark shelter / Reptipor odor remover); Absorption Corp. (Carefresh pet bedding); Sunshine Mealworms (cricket gift certificate); Vivarium Publishing Group (*Vivarium* subscription); Tetra (ReptoMin turtle food); Midwest Zoological Research (NutriBACdf supplement); ZooMed (Min/Max Thermometer); Four Paws (Nature's Heat under-tank heat mat); Super Pet (Little Critter Kit / ceramic dishes / Floating Island); Fluker Farms (Repta-Lawn natural substrate); Reptile Emporium (InsectNside candy / Larvets Worm Snax); Gary Fogel (lizard squeaky toy); Lori King (grapevine cage decor); Rich Crowley – CHS Adoptions (light & fixture); Jack Schoenfelder – Reptiques (fishbowl); Marcia Rybak (West Indian Iguana Specialist Group T-shirt / desert tortoise mousepad).

THE ADVENTURES OF SPOT



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